This question paper contains **7** printed pages]

Roll No. | | | | | | | | | | |

S. No. of Question Paper : **5666**

Unique Paper Code : **2342012403**

Name of the Paper : **Computer Networks**

Name of the Course : **B.Sc.(H) Computer Science**

Type of Paper : **DSC (NEP-UGCF-2022)**

Semester : **IV**

Duration : **3 Hours** Maximum Marks : **90**

(Write your Roll No. on the top immediately on receipt of this question paper.)

This question paper has two Section A and B.

Question **1** in Section-A is compulsory.

Attempt any *four* questions from Section-B.

Parts of a question must be attempted together.

Section A carries **30** marks and each question in Section B carries **15** marks.

Section–A

1. Answer the following questions :

(*a*) Explain the *three* types of services provided by the Data Link Layer. 3

(*b*) What is the purpose of the following flag bits with respect to the TCP header ? 3

(*i*) SYN

(*ii*) ECE

(*iii*) URG.

P.T.O.

(*c*) State the purpose of the following IP addresses : 3

(*i*) 0.0.0.0

(*ii*) 127.xx.yy.zz

(*iii*) 255.255.255.255

(*d*) Name the layer of the TCP/IP model which performs the following services : 3

(*i*) Process-to-Process Delivery

(*ii*) Source-to-Destination Delivery

(*iii*) Framing.

(*e*) Write the different kinds of transfer modes used in HDLC protocol. What is the purpose of using I-frame and S-frame ? 3

(*f*) State Shannon Capacity theorem. Consider an extremely noisy channel in which the signal-to-noise ratio is 40 dB. Compute the bit rate if the bandwidth of the channel is 1 kHz. 3

(*g*) Evaluate the Ring, Star, and Mesh topology based on the following criteria : 3

(*i*) Security

(*ii*) Cost

(*iii*) Scalability.

(*h*) Compare the Virtual Circuit approach and Datagram Network approach based on the following parameters : 3

(*i*) Quality of Service

(*ii*) Effect of Router Failure

(*iii*) Congestion Control.

(*i*) What type of unguided media is used for the following applications ? 3

(*i*) Satellite networks

(*ii*) AM and FM

(*iii*) Television remotes.

(*j*) A URL has three components. Extract the three components of the given URL : http://www.abc.india.edu/index.html 3

Section–B

2. (*a*) Explain the *three* CSMA protocols. 3

(*b*) How long does it take for a station to detect a collision in the CSMA/CD protocol ? Justify your answer with the help of a diagram. 4

(*c*) Define Hamming code. Consider a coding scheme with the following legal codewords : 00010111, 11110010. Calculate its Hamming distance. 2

(*d*) Compute the bit stream transmitted using Hamming code with even parity for the message M = 1101101. Show the steps to detect and correct an error at the receiver's end if the third bit from the left is inverted during transmission. 6

3. (*a*) Discuss the different types of transmission impairment. 3

(*b*) Analyse Frequency Division Multiplexing (FDM) and Wavelength Division Multiplexing (WDM) based on the parameters such as Bandwidth utilization, Interference/Crosstalk, Cost, and Signal type. 4

(*c*) The following character encoding is used in a data link layer protocol : 8

A : 11010101

B : 10101001

FLAG : 01111110

ESC : 10100011

Show the bit sequence transmitted (in binary) for the five-character frame A ESC B ESC FLAG when each of the following framing methods is used :

(*i*) Character count

(*ii*) Flag bytes with byte stuffing

(*iii*) Starting and ending flag bytes with bit stuffing.

Also, find the original data for the given output obtained after applying the byte-stuffing technique :

FLAG A B ESC ESC C ESC FLAG ESC FLAG D E FLAG

4. (*a*) "Distance Vector Routing algorithm reacts rapidly to good news but leisurely to bad news". Justify the statement. 2

(*b*) Consider a network of six routers labelled A, B, C, D, E and F. The cost of the links between the routers is as follows : 5

(*i*) A-B : 4

(*ii*) A-E : 5

(*iii*) B-C : 2

(*iv*) B-F : 6

(*v*) C-D : 3

(*vi*) C-E : 1

(*vii*) D-F : 7

(*viii*) F-E : 8

The following information has just arrived at the router C :

- From B : (5, 0, 8, 12, 6, 2)
- From D : (16, 12, 6, 0, 9, 10)
- From E : (7, 6, 3, 9, 0, 4)

The measured delays to B, D and E are 6, 3 and 5 respectively. Using distance vector routing algorithm, give the new routing table for C specifying both the delay and the outgoing line to use.

(*c*) How IPv6 is more secure than the IPv4 protocol ? Discuss the various fields of IPv6 headers with the help of a diagram. Why is the Header checksum of an IPv4 packet computed at every hop from source to destination ? 8

5. (*a*) Explain the working of Stop and Wait protocol. 4

(*b*) What kind of duplexing mode is used in the following applications : 3

(*i*) Voice over IP

(*ii*) Walkie-Talkie

(*iii*) Telephone.

(*c*) Given the IP address **200.1.2.30,** an organization needs to create two subnets : 6

(*i*) Find the class of the given IP address using classful addressing.

(*ii*) Determine the starting IP address and the last IP address of each subnet.

(*iii*) Give the subnet mask for the given IP address.

(*iv*) How many hosts can be on each subnet ?

(*d*) Explain the purpose of DHCP protocol. 2

6. (*a*) Compare and contrast TCP and UDP with respect to the following parameters : 7

(*a*) Connection

(*b*) Speed of data transfer

(*c*) Header size

(*d*) Reliability

(*e*) Sequence of the segment received at the destination.

Also, give the minimum and maximum size of a TCP segment.

(b) Discuss the various request methods provided by HTTP. 4

(c) Ravi writes an email to his friend and clicks the "Send" button. During this process, a protocol is responsible for transferring Ravi's message from his mail server to the recipient's mail server over the internet. Which protocol is involved in this transfer, and how does it facilitate communication between the mail servers ? 4

7. (a) Describe the various phases that a PPP connection goes through. Also give the Transition Phase diagram. 5

(b) We need to send 265 Kbps data over a noiseless channel with a bandwidth of 20 kHz. How many signal levels do we need ? 2

(c) Give any *two* advantages and *two* disadvantages of Optical Fiber. 4

(d) Eight 1-Kbps connections are multiplexed together using TDM. Each unit is 1-bit. Find : 4

(i) The duration of 1 bit before multiplexing

(ii) The transmission rate of the link

(iii) The duration of a time slot

(iv) The duration of a frame.